REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**44-7877**
SRP Section:	**07.04 – Safe Shutdown System**
Application Section:	**07.04**
Date of RAI Issue:	**06/23/2015**

Question No. 07.04-1

Demonstrate how the transfer of control functions from the main control room (MCR) to the remote shutdown room (RSR) operates independently. Describe how the hardware transfer switches that trigger software switches within the software portion of the design shown in APR1400 FSAR, Tier 2, Figures 7.4-1, 7.4-2, and 7.4-3, maintain independence.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 19, "Control room," and NUREG-0800, SRP Section 7.4, require, in part, that equipment at appropriate locations outside the control room shall be provided and should be capable of operating independently of (i.e., without interaction with) the equipment in the main control room.

According to APR1400 FSAR, Tier 2, Figures 7.4-1, 7.4-2, and 7.4-3, the hardware transfer switches provide input to trigger software switches within the software portion of the design. It is not apparent from the design as to how the transfer of control functions from the MCR to the RSR operates independently. Revise APR1400 FSAR, Tier 2, Figure 7.1-1, and other supporting figures, to reflect the transfer switches located at the maintenance and test panel (MTP) and RSR, the fiber optic cable, and the connection to which components within the safety-related I&C system.

Response - (Rev. 1)

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Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

Safety I&C TeR (APR1400-Z-J-NR-14001-NP) will be revised as indicated on the attached markup.

4.7.6 Main Control Room/Remote Shutdown Room Master Transfer Switch

4-32

Figure 4-29 Transfer of ESCM control function signals from MCR to RSR
Figure 4-30 Transfer of Control functions for MI switch signals from MCR to RSR

4.8 Reactor Trip Switchgear System

4.8.1 Functions

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4.8.2 Design Features

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Insert “A” which is on following 4pages

4.7.6 Main Control Room/Remote Shutdown Room Master Transfer Switch

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Question No. 07.04-2

APR1400 FSAR, Tier 2, Section 7.4.1.l, describes how the use fiber optic cables for the MCR/RSR master transfer switches provides the isolation between the Engineered Safety Features - Component Control System (ESF-CCS) divisions and the Process-Component Control System (P-CCS). However, as shown in APR1400 FSAR, Tier 2, Figures 7.4-1 and 7.4-2, the isolation occurs in software switches within the ESF-CCF and the P-CCS.

10 CFR Part 50, Appendix A, GDC 24, “Separation of Protection and Control Systems” requires in part, the protection system be separated from control systems to the extent that failure of any single control system component or channel, or failure or removal from service of any single protection system component or channel which is common to the control and protection systems leaves intact a system satisfying all reliability, redundancy, and independence requirements of the protection system as well as assuring that interconnection of the protection and control systems is limited to assure that safety is not significantly impaired. APR1400 FSAR, Tier 2, Figures 7.4-1 and 7.4-2 reflect both MCR/RSR Master Transfer Switches triggering the MCR/RSR Master Transfer Logic and does not provide any isolation between ESF-CCF and P-CCS divisions. Clarify the design descriptions for interconnections involving the MCR/RSR Master Transfer Switches.

Response - (Rev. 1)

Two types of master transfer switches (MTSs) are provided at different locations. The local MTS of each division is located in the maintenance and test panel (MTP) cabinet in the corresponding I&C equipment room, and the remote MTS of each division is located on the remote shutdown console (RSC) in the remote shutdown room (RSR).

The local MTS of each division is directly hardwired to the control channel gateway (CCG) and the group controller (GC) in the I&C equipment room. The remote MTS on the RSC of each division is hardwired to the control panel multiplexer (CPM) located on the RSC. This CPM is

connected to the CCG and the GC in the I&C equipment room through the serial data link (SDL) which is fiber optic cable.

Fiber optic cables are applied to the SDL to connect the CPM in the RSC and the CCG and GC in the I&C equipment room of each division.

For isolation between the ESF-CCS and the P-CCS, the ESF-CCS of each safety division sends the control and interlock data to the P-CCS via the MTP and Ethernet communication. The communication is unidirectional and uses fiber optic cable.

In addition, the P-CCS sends several control signals to the ESF-CCS. Figure 7.4-2-1 on the page 3 of this response shows a typical example of non-safety control signals sent from P-CCS to ESF-CCS. In this figure, the signals from the non-safety P-CCS for CV-515 are electrically isolated and have communicational independence from the ESF-CCS through the use of isolators between the P-CCS controller and the ESF-CCS controller.

CV-515 is a safety valve and is automatically controlled by an ESFAS signal. The ESF-CCS control logic ensures a non-safety control signal can only close the valve.

Therefore, the non-safety control signal cannot cause spurious opening of the valve at any time.

Control of CV-515 is transferred to the RSR while maintaining the isolation feature between the ESF-CCS and the P-CCS in the following ways:

- RSR transfer for ESCM data between the MCR and the RSR is accomplished in the CCG by the local MTS and remote MTS,
- MCR control for ESCM data is accomplished in the CCG by the local MTS and remote MTS,
- According to the result of RSR transfer, only one signal of ESCM is enable between coming from the MCR and coming from the RSC,
- Enabled ESCM data either the MCR or the RSC is transmitted to the ESF-CCS loop controller (LC),
- The “NOT function” present between the S-R memory gate and the AND function in Figure 7.4-2-2 allows only one ESCM data signal, either from the MCR or the RSC, to be sent to the loop controller via the SDN,
- The component control logic for CV-515 is provided in the LC as shown on Figure 7.4-2-3,
- The LC receives non-safety control signal from P-CCS and ESFAS signal as well as enabled ESCM data from the CCG,
- The LC executes the control logic according to conditions of input signals

The signal from the P-CCS is isolated by the fiber optic cable between ESF-CCS LC and P-CCS.

One set of local MTSs consists of six switches for Divisions A, B, C, and D for the safety divisions and N1 and N2 for the non-safety-related divisions, and is installed in the I&C equipment room of the corresponding division.

One set of remote MTSs also has six switches on the RSC, and is separated from the other sets by a distance.

These switches are interfaced to the CCG and GC of the corresponding division.

Therefore, the isolation feature for RSR transfer is maintained between the ESF-CCS and the P-CCS.

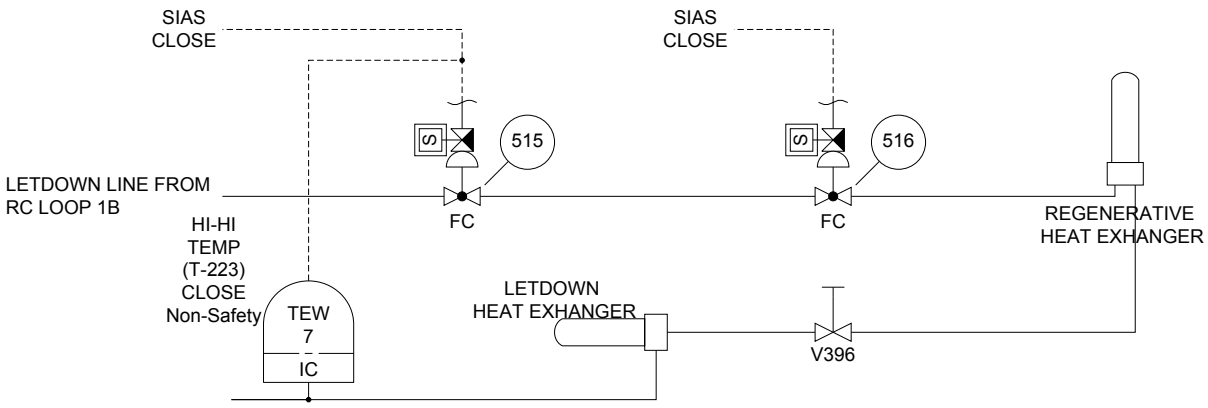

Figure 7.4-2-1 Non-safety control signals sent from P-CCS to ESF-CCS

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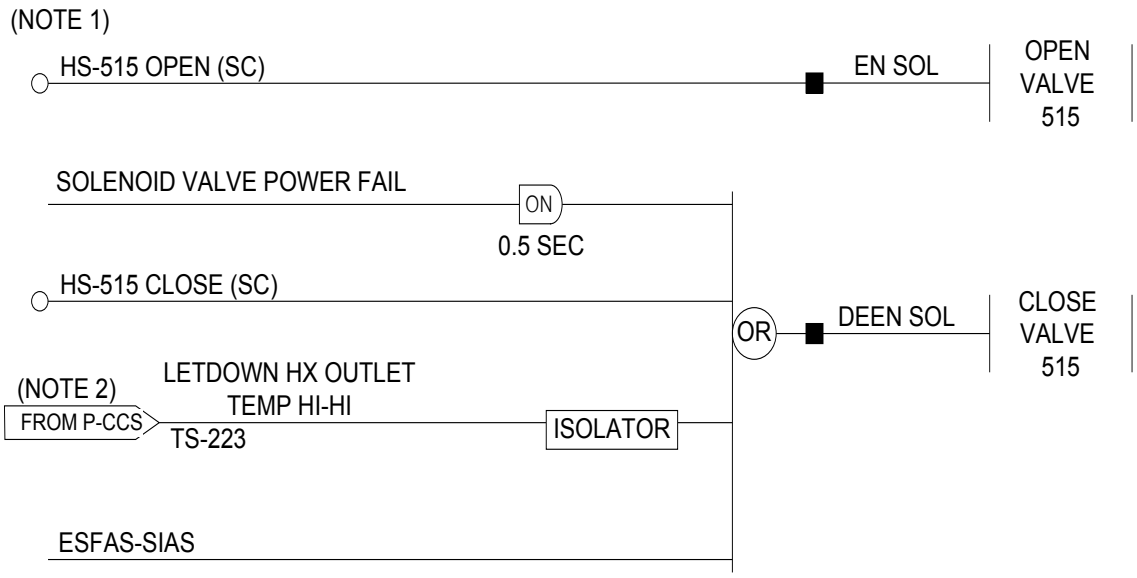

Figure 7.4-2-3 Component control logic in LC

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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Question No. 07.04-4

Clarify how signals from ESF-CCS Software Control Module (ESCM) in both the MCR and RSR are transferred via the MCR/RSR Master Transfer Switches.

10 CFR Part 50, Appendix A, GDC 19, "Control room," requires in part that equipment at appropriate locations outside the control room shall be provided and should be capable of operating independently of (i.e., without interaction with) the equipment in the main control room. APR1400 FSAR, Tier 2, Section 7.4.1.l, states "all signals from the MCR are disabled and signals from the RSR are enabled. This includes signals from the ESCM and signals interfaced via the control panel multiplexers (CPMs)." The staff found in APR1400 FSAR, Tier 2, Figure 7.1-1, that signals from the ESCMs (located in safety console (SC), MCR, and RSR) input into the Safety System Networks, whereas, signals from the CPMs (located in SC and RSR) have serial data links into the ESF-CCF GC. It is unclear as to how the Safety System Networks signals are transferred to the RSR using the MCR/RSR Master Transfer Switches. Clarify how signals from the ESCMs (SC, MCR, and RSR) are transferred via the MCR/RSR Master Transfer Switches.

Response - (Rev. 1)

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Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.